length of the heating. chamber. This gives a space at each end of the heating chamber for the formation of the flame. The velocities of the gas and air entering the heating chamber are approximately the same. The air ports are located on each side of the gas port. This furnace works hot and has a good output. The ports shown in Fig. 145 were designed for use with natural gas, which was jetted into the port at right angles with the stream of preheated air and close to the bottom of the port. These ports were also intended to permit the use of producer gas in case of the failure of the natural gas supply, there being two regenerator chambers at each end of the furnace. With natural gas both chambers were used for air. With producer gas the uptakes nearest the heating chamber were for gas and those further back were for air. With this design of port the stream of gas impinges upon the stream counter to the air current. This would tend to form a mixing eddy at point of junction.

The port arrangement shown in Fig. 146 is that used in many American furnaces. In this design the air velocity is comparatively low, while the gas velocity is from four to ten times the air velocity. One of the reasons that has been advanced for this port arrangement is that it forms a blanket of air between the flame and the roof, reduces the wear on the roof and protects the bath from the oxidizing effect of the air. This design of port gives an extremely long flame. The flame is forced away from the port and the ends of the heating chamber work alternately hot and cold. The introduction of this design of port resulted in an increase in the length of the heating chamber in order to prevent the flame passing beyond the heating chamber. Then the gas velocity was increased to force the flame to the end of the chamber.

Fig. 143 is a diagram in which have been plotted the areas of the gas and air ports as tabulated in Table 5. The wide

difference in the ideas of port areas is well illustrated.

With oil, pulverized coal, coke-oven and natural gas, the fuel is piped to the furnace and used without preheating. The fuel is introduced at the end bulkhead or through the sides of the heads.

Blue water gas has been used in some foreign furnaces. As this gas contains practically no hydrocarbons it may be preheated.

A few attempts have been made to utilize blast-furnace gas in the open-hearth. It may be clone by preheating to a higher temperature than is usual with the ordinary mixed producer gas.